Haeckel is so popular that Watts & Co., the English publishers of his *Riddle of the Universe* and *The Evolution of Life* have engaged Mr. Joseph McCabe to translate this new work under the title, *The Wonders of Life; a Popular Study of Biological Philosophy.* The book forms a stately volume of 500 pages and the translation is well done.

The American edition is published by Harper.

EUCLID'S PARALLEL POSTULATE: Its Nature, Validity, and Place in Geometrical Systems. By *John William Withers.* Chicago: The Open Court Publishing Company. 1905. Pp. vi, 192.

Mr. Withers, Principal of the Yeatman High School of St. Louis, Mo., has taken his Doctor's degree on the thesis "Euclid's Parallel Postulate," and its significance for other systems of hyperspace than is known to us in our tri-dimensional world. The book is scholarly and the arguments are sober. Dr. Withers begins with an historical exposition of his problem, relating the difficulties discovered in the parallel postulate and the several methods of disposing of it, one main result being the discovery and development of non-Euclidean systems. He explains the nature of the problem and its philosophical bearings. He then discusses the psychology of the parallel postulate, comparing it to its kindred conceptions. Finally he treats of its validity which is not *a priori* necessary, but most convenient. He says:

"The world, as our actual experience reveals it, is certainly tri-dimensional; judged by the same standard, it is also Euclidean. If, then, only one variety of tri-dimensional space is possible, if non-Euclidean tri-dimensional geometry really demands a fourth dimension, the so-called non-Euclidean spaces are in reality not spaces at all, for they are not self-dependent totalities. It is not, then, a question as to whether non-Euclidean geometries are possible, but a question as to whether non-Euclidean tri-dimensional spaces are possible. It is, of course, possible to construct such geometries by making use of the idea of a fourth dimension, just as we ordinarily build up our plane geometry by frequently referring to figures which are only possible in a third dimension; but this, of course, is very different from establishing the possibility of non-Euclidean tri-dimensional spaces.

"The question, then, simply reduces to this: Are tri-dimensional space-worlds rationally possible whose internal relations considered as totalities are essentially different from each other? And it is answered by showing that the geometries of such spaces can be constructed without appealing to a fourth dimension. This can be done. As in the case of two-dimensional spaces, we have here also all the conditions necessary to render such geometries possible. Indeed, the most interesting and significant feature of non-Euclidean solid geometries lies in the fact that they are just as independent of a fourth dimension as is Euclid itself. There are, to be sure, certain facts

in all these geometries that make us wish sometimes for a fourth dimension and the power of moving into it, but they do not necessarily imply this dimension. The simple principle of congruence fails, for example, if we attempt to apply it directly in proving the equality of two Euclidean pyramids whose corresponding parts are mutually equal but arranged in reverse order. The analogous theorem in plane geometry is proved by obverting one of the triangles in the third dimension. Were there a fourth dimension and had we the power of moving into it, it is conceivable that this might also be done for the pyramids. What would happen is simply this: By obverting one of the pyramids in the fourth dimension and then returning it to its own tri-dimensional world, its relations to the other objects of this world are changed in a way that is wholly impossible so long as we confine it to three dimensions. But the internal relations of the pyramid itself, as in the observed case of the triangle, remain entirely unaltered. The self-identity of the figure is retained. But as we have said, these facts cannot be regarded as implying the logical dependence of Euclid, or of non-Euclid, upon a fourth dimension."

The author sums up his inferences as to the nature of space by recognising that only pure logic is strictly *a priori*, while geometry with its space-conception contains an element of experience the actuality of which can only be proved empirically. We sum up the situation in his own words:

"The only *a priori* manifold at present definable in Kant's sense of *a priori* seems to be a manifold constituted by a totality of logical classes or distinctions of any similar sort. The constitution of such a complete system of logical entities must be implicitly known to any rational being.....

"The connection between this *a priori* logical manifold and the empirical space of our own experience lies in the fact that the space-aspect of experience is the one which most definitely implies and is implied by our power to co-ordinate our activities so that "*a* leads to *b* leads to *c*," etc. It is that aspect which enables us to introduce illative relations among acts and systems of acts of our own (acts actual and acts possible).

"*That* this aspect of experience exists is an empirical fact. *What* correlations of acts it permits and *how* it permits them are also empirical. All the details are empirical. But if it is to permit such a system at all, it has to conform to the general type of the illative relation and its parts viewed as coexistent must be related to each other in accordance with the general type of an illative relation."

THE FOURTH DIMENSION. By *C. Howard Hinton.* London: Swan Sonnenschein & Co. 1904. Pp. vi, 247.

Mr. Howard Hinton, already well known from the publication of his *Scientific Romances*, ably written rambles into the domains of metageometry